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ABSTRACT

This packet contains a program guide and Career Merit Achievement Plan (Career MAP) for the implementation of a communication electronics (communications technician) program in Florida secondary and postsecondary schools. The program guide describes the program content and structure, provides a program description, lists job titles under the program, and includes a curriculum framework and student performance standards for communication electronics courses. The curriculum framework outlines major concepts and content, laboratory activities, program specifics, and intended outcomes; the student performance standards guide lists each standard and the behaviors expected to show mastery of each standard. The guide also provides information on the following: (1) program implementation; (2) instructional resources (a listing of 26 print materials, 11 audiovisuals, and 6 software programs, with publishers' addresses); (3) facility design for communication electronics laboratories and classrooms, equipment, safety, maintenance, and liability; and (4) teacher professional development, teacher certification, professional organizations and support services. The Career MAP is a checklist, to be kept by student and teacher, of student progress in the competencies required for entry into jobs in the communication electronics field. (KC)

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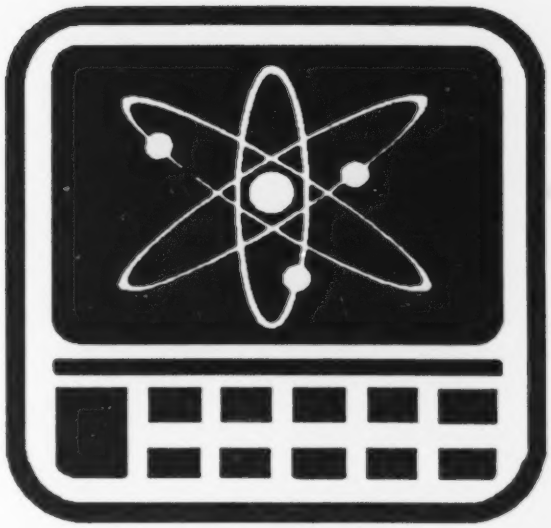

FLORIDA VOCATIONAL PROGRAM GUIDE FOR COMMUNICATION ELECTRONICS

Prepared by

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Tallahassee, Florida
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INTRODUCTION

Vocational education meets the needs of students desiring to pursue a selected vocation and is designed to provide training that is realistic in meeting present and future employment opportunities. In recent years, applications of science and technology have expanded rapidly, increasing the education and training required of workers. This has made vocational training programs more attractive as an educational option. The new technologies require well-trained workers to carry out both standardized and specialized procedures, and whose training foundations have given them the capacity to keep pace with continuing technology demands.

The Florida Department of Education shares with business and industry the determination to provide opportunities for upward mobility to as many Floridians as possible. Vocational training programs can keep pace with the demands of new industrial patterns and can provide the opportunity for many of our citizens to gain financial stability and an improved sense of self worth. Therefore, it is necessary to create exemplary vocational programs and to make those programs consistent throughout the state.

This Program Guide identifies primary concerns that should be considered in the organization, operation and evaluation of a vocational education program. It has been developed to provide useful information to local school district and community college administrators, instructors, program advisory committees, regional coordinating councils and others charged with the responsibility of offering vocational education programs.

OCCUPATIONAL DESCRIPTION

A principle occupational title is identified for each vocational training program. This title is validated by the United States Department of Labor Dictionary of Occupational Titles (DOT) or other appropriate references. Such references may be the United States Department of Commerce Standard Occupational Classification Manual (SOC), the Occupational Employment Statistics Survey Dictionary (OES), or Vocational Preparation and Occupations (VPO) prepared by the National and State Occupational Information Coordinating Committees. Information obtained from industry advisory committees may also be used to validate the principle occupational title. The job title and code number for this program are listed in the curriculum framework which accompanies this guide.

The United States Department of Labor Dictionary of Occupational Titles (D.O.T.) identifies the job title for this occupational area as follows:

D.O.T. JOB TITLE	D.O.T. CODE
Communications Technician	828.281-010

The definition (description) for this job title is taken from the D.O.T. for easy reference.

COMMUNICATIONS TECHNICIAN

Repairs electronic equipment, such as computers, industrial controls, radar systems, telemetering and missile control systems, transmitters, antennas and servomechanisms, following blueprints and manufacturer's specifications, and using handtools and test instruments: Tests faulty equipment and applies knowledge of functional operation of electronic units and systems to diagnose cause of malfunction. Tests electronic components and circuits to locate defects, using oscilloscopes, signal generators, ammeters and voltmeters. Replaces defective components and wiring and adjusts mechanical parts, using handtools and soldering iron. Alines, adjusts and calibrates equipment according to specifications. Calibrates testing instruments. Maintains records of repairs, calibrations and tests. May install equipment in industrial or military establishments and in aircraft and missiles. May operate control systems in ground and flight tests, and be required to hold license from governmental agency. May be designated according to type of equipment repaired as CUSTOMER-ENGINEERING SPECIALIST

(office mach.); ELECTRONICS MECHANIC, COMPUTER (any ind.); RADAR MECHANIC (any ind.); VOTING-MACHINE REPAIRER (gov. ser.)

PROGRAM CONTENT

The Division of Vocational, Adult, and Community Education, as required by State Board of Education **(S.B.E.) Rule 6A-6.0571**, publishes Vocational Education Program Courses Standards annually. This document specifies the minimum program content for the operation of a vocational training program for the occupational titles listed. Each program identified in the Florida Department of Education Course Code Directory is required to establish course standards. The standards for each vocational offering are comprised of two major components: (1) Curriculum Framework and (2) Student Performance Standards.

Curriculum Framework (CF)

The Curriculum Framework specifies the exact course title, course number, levels of instruction, major course content, laboratory activities, special notes, major course concepts and intended outcomes. The program requirements stipulated in the curriculum framework have been approved by the State Board of Education and are the legal bases for delivery of instruction.

Student Performance Standards (SPS)

The Student Performance Standards are a resource list of job-specific competencies. This list is generated and approved by industry experts and becomes the basis for curriculum development in vocational programs. Local school districts and community colleges must, by law, adopt student performance standards for their vocational programs. They may, at their discretion, adopt the list provided or develop their own as long as there is sufficient content to address each intended outcome. A program may provide instruction beyond the minimum specified in the SPS if desired. The decision to do this should be based on local industry needs. However, the minimum must be presented.

The SPS for secondary level programs contain a third component, course structure. This component specifies the number of courses required for program completion and the content of each course. The courses may be taught in any sequence, but the content may not be changed unless approved by the Division of Vocational, Adult, and Community Education.

The curriculum framework and student performance standards are intended for use as a guide, not a teaching tool. Teachers or curriculum development personnel are expected to develop or select complete curriculum materials for their training programs based on the curriculum framework and student performance standards. Each intended outcome and SPS should be thoroughly analyzed for related cognitive and procedural subskills. The curriculum framework and student performance standards are presented in the following pages.

PROGRAM CONTENT COMMUNICATION ELECTRONICS

CURRICULUM FRAMEWORK PROGRAM AREA: Industrial

FLORIDA DEPARTMENT OF EDUCATION EFFECTIVE DATE: July, 1991

PROGRAM TITLE: Communication Electronics

CODE NUMBER: Secondary _____ Postsecondary EEV0310

Florida CIP 0647.010300

SECONDARY SCHOOL CREDITS ___ COLLEGE CREDITS ____ POSTSECONDARY ADULT VOCATIONAL CREDITS ____

APPLICABLE LEVELS(S): ___ 7-9 ___ 9-12 _X_ Postsecondary Adult Vocational

___ Postsecondary Vocational _X_ Other 30-31

CERTIFICATION COVERAGE: TEC ELEC @ 7 ELECTRONIC 7 RADIO COMM @ 7

I. MAJOR CONCEPTS/CONTENT: The purpose of this program is to prepare students for employment as a communications technician. This program also provides supplemental training for persons previously or currently employed in this occupation.

The course content will include the following: operation, maintenance and repair of AM and FM radios, single and double side band radios, data communication equipment, mobile radio/telephone systems, fiber optic systems, microwave equipment and satellite systems. The course content should also include training in communication, leadership, human relations and employability skills; and safe, efficient work practices.

II. LABORATORY ACTIVITIES: Shop or laboratory activities are an integral part of this program. These activities provide instruction in the use of tools, equipment, materials and processes found in the industry. Students will use various types of precision test equipment for analyzing, troubleshooting and repairing communication equipment.

III. SPECIAL NOTE: The Vocational Industrial Clubs of America, Inc. is the vocational student organization which reinforces classroom instruction by providing communications, leadership, human relations and employability training experiences. It also reinforces specific vocational skills. When provided, these activities are considered an integral part of this program.

The cooperative method of instruction may be utilized for this program. When the cooperative method is offered, the following is required for each student: a training plan signed by the student, teacher and employer which includes instructional objectives and a list of on-the-job and in-school learning experiences; and a work station which reflects equipment, skills and tasks relevant to the occupation the student has chosen as a career goal. The student must receive compensation for work performed.

Electronic Technology and/or Electronic Engineering Technology are

Electronic Technology and/or Electronic Engineering Technology are prerequisites for entry into this electronic specialization. Algebra is recommended as a prerequisite for entry into this program

In accordance with Section 233.0695 F.S., the minimum basic skills grade level required for this postsecondary adult vocational program is: Mathematics 10.0, Language 9.0. This grade level number corresponds to a grade equivalent score obtained on a state designated basic skills examination.

To be transferable statewide between institutions, this program/course must have been reviewed, and a "transfer value" assigned the curriculum content by the appropriate Statewide Course Numbering System discipline committee. This does not preclude institutions from developing specific program or course articulation agreements with each other.

This program may be offered in courses. Vocational credit shall be awarded to the student on a transcript in accordance with Section 230.643 F.S..

The typical length of this program for the average achieving student is 960 hours.

IV. INTENDED OUTCOMES: After successfully completing this program, the student will be able to:

01. Demonstrate proficiency in amplitude modulated radio transmitter and receiver systems.
02. Demonstrate proficiency in double side band and single side band radio systems.
03. Demonstrate proficiency in frequency modulated radio transmitter and receiver systems.
04. Demonstrate proficiency in high frequency AM and FM two-way radio systems.
05. Demonstrate proficiency in microwave systems.
06. Demonstrate proficiency in satellite systems.
07. Demonstrate proficiency in video systems.
08. Demonstrate proficiency in commercial audio systems.
09. Demonstrate proficiency in data communications.
10. Demonstrate proficiency in fiber optic communications systems.

STUDENT PERFORMANCE STANDARDS EFFECTIVE DATE: July, 1991

PROGRAM AREA: Industrial SECONDARY NUMBER:

PROGRAM TITLE: Communication Electronics POSTSECONDARY NUMBER: EEV0310

01.0 DEMONSTRATE PROFICIENCY IN AMPLITUDE MODULATED RADIO TRANSMITTER AND RECEIVER SYSTEMS--The student will be able to:

01.01 Describe the operation of amplitude modulated (AM) radio systems.
01.02 Identify the stages of AM radio transmitters and receivers.
01.03 Define principles of AM modulation.
01.04 Analyze and troubleshoot AM transmitter and receiver circuits to include mixers, IF amplifiers, local oscillators, modulators, demodulators and microphones.
01.05 Align intermediate frequency (IF) circuits using the AM signal generator or sweep generator and oscilloscope.
01.06 Measure the IF section bandwidth using a sweep generator and an oscilloscope or signal generator and a spectrum analyzer.
01.07 Measure input voltage sensitivity to the receiver using a signal to noise ratio meter or spectrum analyzer.
01.08 Determine signal to noise ratio.
01.09 Conduct operating systems checks of AM transmitter and receiver circuits and make minor adjustments.
01.10 Set up and adjust AM antenna systems using a power meter and standing wave ratio (SWR) meter.
01.11 Analyze AM radio circuits using spectrum analyzers, noise analyzers impedance bridges, sweep generators, dummy loads and phase meters.
01.12 Measure AM radio signals using power meters, field strength meters and distortion meters.
01.13 Analyze, troubleshoot and adjust AM heterodyning, frequency synthesis, phased locked looped, signal filtering and automatic control circuits.
01.14 Analyze, troubleshoot and adjust radio frequency (RF) power amplifier circuits for AM radio transmitters.
01.15 Analyze, troubleshoot and adjust AM stereo transmitter and receiver circuits.

02.0 DEMONSTRATE PROFICIENCY IN DOUBLE SIDE BAND AND SINGLE SIDE BAND RADIO SYSTEMS--The student will be able to:

02.01 Describe the operation of double side band suppressed carrier (DSSC) radio systems.
02.02 Identify the stages of DSSC radio transmitters and receivers.
02.03 Analyze and troubleshoot DSSC transmitter and receiver circuits.
02.04 Conduct operating systems check of DSSC circuits and make minor adjustments.
02.05 Describe the operation of single side band (SSB) radio systems.
02.06 Identify the stages of SSB radio transmitters and receivers.
02.07 Analyze and troubleshoot SSB transmitter and receiver circuits.
02.08 Conduct operating systems check of SSB circuits and make minor adjustments.
02.09 Set up and adjust SSB and DSSC antenna systems using power meters and SWR meters.

02.10 Analyze or measure SSB and DSSC radio circuits using spectrum analyzers, noise analyzers, impedance bridges, sweep generators, dummy loads and phase meters.
02.11 Analyze and measure SSB and DSSC radio signals using power meters, field strength meters and distortion meters.
02.12 Analyze, troubleshoot and adjust SSB and DSSC heterodyning, frequency synthesis, phased locked looped, signal filtering and automatic control circuits.
02.13 Analyze, troubleshoot and adjust RF power amplifier circuits for SSB and DSSC radio transmitters.

03.0 DEMONSTRATE PROFICIENCY IN FREQUENCY MODULATED RADIO TRANSMITTER AND RECEIVER SYSTEMS--The student will be able to:

03.01 Describe the operation of frequency modulated (FM) radio systems.
03.02 Identify the stages of FM radio transmitters and receivers.
03.03 Define principles of FM modulation.
03.04 Analyze and troubleshoot FM transmitter and receiver circuits.
03.05 Align IF circuits using an FM signal generator and sweep generator.
03.06 Measure IF section bandwidth using an oscilloscope or spectrum analyzer.
03.07 Measure receiver input voltage sensitivity to receiver antenna input using a signal to noise ratio meter or spectrum analyzer.
03.08 Conduct operating systems check of FM transmitter and receiver circuits and make minor adjustments.
03.09 Analyze and troubleshoot FM stereo transmitter, receiver and digital tuning circuits.
03.10 Conduct operating systems check of broad band FM stereo transmitter and receiver circuits and make minor adjustments.
03.11 Analyze, troubleshoot and adjust the standard FM right and left channel subcarrier and the subsidiary carrier authority (SCA) signal.
03.12 Analyze, troubleshoot and adjust phase modulation circuits.
03.13 Analyze, troubleshoot and adjust FM pulse modulation circuits.
03.14 Analyze, troubleshoot and adjust FM multiplex circuits.
03.15 Analyze, troubleshoot and adjust wide band and narrow band FM transceiver circuits.
03.16 Set up and adjust FM antenna systems using a power meter and SWR meter.
03.17 Analyze or measure FM radio circuits using spectrum analyzers, noise analyzers, impedance bridges, sweep generators, dummy loads and phase meters.
03.18 Analyze and measure FM radio signals using power meters, field strength meters and distortion meters.
03.19 Analyze, troubleshoot and adjust FM heterodyning, frequency synthesis, phased locked looped, signal filtering and automatic control circuits.
03.20 Analyze, troubleshoot and adjust RF power amplifier circuits for FM radio transmitters.

04.0 DEMONSTRATE PROFICIENCY IN HIGH FREQUENCY AM AND FM TWO-WAY RADIO SYSTEMS--The student will be able to:

04.01 Apply Federal Communications Commission (FCC) rules and regulations to communication requirements.

04.02 Describe the operation of high frequency (HF), very high frequency (VHF) and ultra high frequency (UHF) AM and FM two-way radio systems.
04.03 Identify the stages of HF, VHF and UHF AM and FM two-way radio systems.
04.04 Analyze and troubleshoot HF, VHF and UHF AM and FM two-way radio transmitter and receiver circuits.
04.05 Set up and adjust HF, VHF and UHF AM and FM antenna systems.
04.06 Analyze and troubleshoot the DC remote control on repeater and remoted base auxiliary equipment.
04.07 Analyze and troubleshoot the tone remote control on repeater and remoted base auxiliary equipment.
04.08 Analyze and troubleshoot the local remote control on repeater and remote base auxiliary equipment.
04.09 Analyze and troubleshoot the RF remote control on repeater and remoted base auxiliary equipment.
04.10 Explain paging and mobile phone communications theory and language.
04.11 Analyze and troubleshoot paging and mobile phone two-tone and five-tone paging and digital formats.
04.12 Analyze and troubleshoot paging and mobile phone signaling and operation.
04.13 Service and repair cellular mobile phones and pagers.

05.0 DEMONSTRATE PROFICIENCY IN MICROWAVE SYSTEMS--The student will be able to:

05.01 Describe the operation of microwave transmission systems.
05.02 Identify the components of microwave transmission systems.
05.03 Analyze and troubleshoot microwave transmitter and receiver circuits.
05.04 Conduct operating systems checks of microwave transmitters and receivers and make minor adjustments.
05.05 Identify local codes and deed restrictions applicable to site surveys for microwave installations.
05.06 Set up and adjust microwave antenna systems.
05.07 Measure microwave system power and SWR.
05.08 Describe procedures to interface a microwave system to a public switched telephone network.

06.0 DEMONSTRATE PROFICIENCY IN SATELLITE SYSTEMS--The student will be able to:

06.01 Describe the operation of satellite systems.
06.02 Identify the components of satellite systems.
06.03 Describe the process of time division multiplexing and frequency division multiplexing used with satellite transponders.
06.04 Analyze, troubleshoot and adjust satellite transponder circuits using a high frequency sweep generator and frequency counter.
06.05 Analyze and troubleshoot video and audio demodulators in satellite receivers.
06.06 Determine location data for satellites.
06.07 Identify local codes and deed restrictions applicable to site surveys for satellite systems.
06.08 Set up and adjust satellite antenna systems.
06.09 Analyze and troubleshoot a satellite receiver low noise amplifier and down converter.

06.10 Describe procedures to interface satellite systems with two-way up link and down link communications equipment.

07.0 DEMONSTRATE PROFICIENCY IN VIDEO SYSTEMS--The student will be able to:

07.01 Analyze and adjust the composition of video signals.
07.02 Define the principles of video signal generation.
07.03 Describe the principles of video multiplex circuits.
07.04 Analyze and adjust black and white and color display circuits.
07.05 Analyze, troubleshoot and adjust the color component of a signal.
07.06 Analyze, troubleshoot and adjust the luminance component of a signal.
07.07 Analyze and troubleshoot the synchronous, horizontal and vertical components of a signal.
07.08 Measure the signal-to-noise ratio for video signals.
07.09 Analyze video circuits using a spectrum analyzer.
07.10 Interconnect video system components using coaxial cables.
07.11 Analyze, troubleshoot and adjust video and RF distribution systems.
07.12 Analyze and adjust a modulator for a video distribution system.

08.0 DEMONSTRATE PROFICIENCY IN COMMERCIAL AUDIO SYSTEMS--The student will be able to:

08.01 Describe the functions of communication system audio components.
08.02 Analyze, troubleshoot and adjust audio amplifier components and speaker system components.
08.03 Define the application of microphone and speaker systems.
08.04 Describe the application of wireless microphones with frequency diversity and the use of equalizers and time delay systems.
08.05 Determine the impedance and power requirements of microphones and speakers.

09.0 DEMONSTRATE PROFICIENCY IN DATA COMMUNICATIONS--The student will be able to:

09.01 Describe the operation of data communications systems.
09.02 Identify the components of data communications systems.
09.03 Analyze and define data communication codes, formats and protocols.
09.04 Identify serial and parallel ports and explain their use.
09.05 Describe the principles of synchronous and asynchronous data transmission systems.
09.06 Identify types of modems and modulation techniques.
09.07 Set up and operate modems.
09.08 Isolate problems of modem operation or common carrier lines.
09.09 Analyze and troubleshoot modems.
09.10 Identify and describe types of carrier systems.
09.11 Interconnect systems using the RS-232 interface standard.
09.12 Describe the operation and bus architecture of local area networks.
09.13 Analyze and troubleshoot base band and broad band local area networks.
09.14 Identify telephone terms and procedures for interfacing wire lines with data networks.

09.15 Analyze and troubleshoot the data communications systems associated with automatic teller machines and credit card readers.
09.16 Describe the operation of lasers used with data transmission.

10.0 DEMOMSTRATE PROFICIENCY IN FIBER OPTIC COMMUNICATIONS SYSTEMS--The student will be able to:

10.01 Identify and describe the basic characteristics of optics such as reflection, refraction and total reflection.
10.02 Identify the characteristics and components of fiber optic cables.
10.03 Describe the modes of propagation used in fiber optic cables.
10.04 Identify bandwidth and attenuation limitations for fiber optic systems.
10.05 Describe the technique of wavelength multiplexing in fiber optic cables.
10.06 Identify and describe the characteristics of various types of light sources and light emitting diodes used for fiber optic systems.
10.07 Identify and describe the components of fiber optic transmission systems.
10.08 Assemble a simple fiber optic data transmission system.
10.09 Analyze and troubleshoot the components of fiber optic data transmission systems.
10.10 Describe the procedures used to interface fiber optic systems with microwave and satellite data transmission systems.

PROGRAM IMPLEMENTATION

It is the teacher's responsibility to ensure that students learn how to competently perform the tasks specified in the course objectives. Therefore, the teacher must lead the students through the learning experiences in a course, motivate students, act as a role model for students, and at times, function as a guidance counselor and placement coordinator. This leadership role requires the teacher to participate in many of the activities required for program implementation. The teacher must select the methods of instruction that best apply to students' ability levels, measure student achievement and provide feedback. Key factors that must be considered when implementing this program are addressed below.

TEACHER CHARACTERISTICS

Subject Knowledge

The teacher must be a subject matter expert who is able to implement sound instructional methods and evaluate student performance. He/she must have significant work experience in the industry/vocational field and be able to communicate that knowledge to the students.

Instructional Delivery

The teacher's role in the learning process is to motivate and lead the student as well as impart subject matter knowledge. In order to maximize student learning, the use of a variety of instructional methods is encouraged. Because teaching styles vary greatly, teachers are highly encouraged to "pick and choose" from various methods or to combine methods for maximum benefit to students. Some of the more traditional methods used are lecture, demonstration and small group instruction. Other teaching methods which are suggested for further exploration include individualized self-paced, open-exit/open-entry, contract, computer based and competency based instruction. The focus of Competency Based Vocational Education (CBVE) is to ensure that each student can competently perform tasks specified before progressing to more complex skills.

CONVENTIONAL INSTRUCTIONAL METHODS

A vocational program may require a portion of the instruction to be presented in a standard lecture or controlled demonstration format. These methods of instruction can be easily combined with instructor controlled step-by-step practical exercises. Some instructional activities may dictate that this instructional approach be used to introduce students to hazardous equipment often utilized in vocational training. In most situations, students should be required to perform specified activities to achieve maximum skill competency. If mastery of a task is required, competency based education methods may be more appropriate. However, if the training activity involves an orientation or a seldom performed, non-essential task, conventional instructional methods may be more effective. Teachers are encouraged to use a variety of instructional methods to best meet instructional objectives.

Instructional Development

Teachers often must develop and select their own teaching and curriculum materials. In developing a comprehensive curriculum, instructional objectives based upon both the performance and cognitive domain must be included. When developing curriculum materials, teachers must use the curriculum framework (CF) and student performance standards (SPS) contained in this program guide as a basis. These materials delineate minimim program content which must be presented for an approved vocational training program. However, they are not intended for use as a comprehensive curriculum. Be certain not to adapt the curriculum to available materials, but select only those materials which can be adapted to the curriculum.

Instructional Measurement

Teachers must select testing methods that support the instructional delivery system used. Teachers must be competent to develop, administer and evaluate written and performance type tests.

Student Admissions Criteria

Providing the student the opportunity to successfully complete a vocational education program, in any institution, should be the primary concern of the instructional effort. Therefore, it is very important to direct planning and effort into identifying and selecting students with excellent potential for success in the educational program and in the occupation. The school's primary task is to prepare people for fulltime, entry-level positions as technicians or, in the case of those with more experience, as managers.

The Course Code Directory, specifies grade levels at which occupational programs are offered. Specific student admissions criteria which are required by the State and local educational agencies for the Communication Electronics training program are illustrated as follows.

SPECIFIC ADMISSIONS CRITERIA

Minimum Age:	As required by state and local policy
Physical Requirements:	None
Special Requirements:	None
Minimum Basic Skills Math Level:	* 10.0
Minimum Basic Skills Language Level:	* 9.0

* This grade level requirement is specified in the Curriculum Framework and is applicable to postsecondary level programs of 450 hours or more only. There is no minimum basic skill requirement for secondary programs.

THE STUDENT PROFILE

Developing a student profile is an important step in program implementation. Attention should focus on student characteristics that can be remediated within a training program, but could create serious impediments to success in the vocational field. Typical of these would be deficiencies in communication and mathematical skills. The basic skill levels can be measured by testing. Test results can then be used to direct the student to more suitable training which matches his or her skill level, or to determine supplemental training which may be required to increase chances for student success.

High school and postsecondary vocational students can be admitted to a vocational program upon request if they meet any specified prerequisites, such as physical or basic skill requirements. Training programs should be accessible to as many students as possible. Training programs are designed to prepare students for employment upon graduation, or serve as prerequisite to a postsecondary program.

The community college can be more selective and establish stringent admission standards. This may be done by assessing applicants or by recruiting potential students who meet the established prerequisite requirements of the training. The program advisory committee can design a profile of the potentially successful student. The profile should contain a

list of qualities, traits and aptitudes that will indicate a higher potential for student success. Acceptable levels for these traits must also be determined. For example, the qualities deserving highest attention, mechanical ability and cognitive aptitude, are those which the educational program itself will not likely be able to influence, although these traits should have considerable weight in establishing the basic profile. Deficiencies in mathematical or communication skills may lend themselves to improvement through related instruction while the student is enrolled in the program. The following example illustrates specific qualities to consider when establishing the student profile:

Mechanic/Technician--Service

- Knowledge of basic tools and equipment used by mechanics/technicians
- Ability to analyze and solve mechanical and technical problems
- Ability to interpret written mechanical/technical materials
- Ability to interpret mechanical/technical drawings
- Mechanical dexterity

Mechanic/Technical Service Management

- Basic application of service
- Business skills
- Ability to work with people
- Communication skills
- Leadership

QUALIFYING AND PRETESTING

Assessing potential students for vocational programs is an integral part of the recruiting process since considerable amounts of time and money will be spent on students entering training. Recruiters must have a good idea of the candidate's basic aptitude. Whoever guides the candidate to the program needs to have knowledge of the student's interests, abilities and experience. These can be measured by a variety of assessment methods, which should be performed upon program entry. The assessment can help determine extent and level of training each individual should receive.

The minimim basic skills requirement for mathematics and language skills is specified on the curriculum framework. Assessment should determine the level at which the student can read, write, calculate mathematics and understand the English language. It is appropriate for the program advisory committee and the school to develop some selection criteria based on minimum skill levels. These criteria should remain flexible in order to maximize educational opportunity for all applicants. Additionally, vocational educators must make every effort to serve the variety of "special needs" students and to eliminate sex-bias and stereotyping in all occupational areas.

ADVISORY COMMITTEE

It is imperative that representatives of industry be organized into an advisory committee. Constantly changing technological demands of our society will continue to stimulate changing industrial patterns. Therefore, effective use of program advisory committees is vital to the successful implementation of vocational training programs. Advisory committees provide expert technical advice which is not easily obtainable elsewhere, offer external support of policies and have tremendous public relations potential.

The most effective advisory committees are those whose members have mutual respect for each other's abilities and vested interest in the training program because of their need for trained workers. The program advisory committee is also one of the most effective means of facilitating placement. Its role can be:

- To contact local industry and encourage them to use the school's placement office as a means of filling jobs
- To develop an effective procedure for interviewing and evaluating potential employees suggested by the school
- To assist in gathering accurate and current job information as it becomes available

COUNSELING AND GUIDANCE

Counseling of students serves two purposes. It guides the student into the program and it supports enrolled students on a continuing basis throughout the program. Much day-to-day counseling will be the responsibility of the teacher. The teacher has the most contact with the student and is in a position to detect and correct a problem. Each student will encounter new problems as the program develops. The teacher's job is to work with the student to help identify problems and then strive for solutions. The teacher will provide much of the counseling that focuses on trade knowledge and skills.

The professional counselor cannot be expected to have the subject matter expertise of the primary teacher. The counselor, however, can focus on the student's needs related to other issues such as personal growth, interests and attitudes. The ideal situation will provide at least one counselor with current knowledge of industry standards for career counseling. A useful tool which should be used in the counseling process is the Career Merit Achievement Plan (Career MAP) which presents minimum instructional content keyed to student performance standards. Career MAPs are available for each industrial program area, and can be used to document student achievement, isolate student interests, talents and weaknesses. They are also useful for placement purposes. Information on Career MAPs may be obtained by contacting the Department of Education, Division of Vocational, Adult, and Community Education, (904) 488-0484.

STUDENT PLACEMENT

Implementing an effective placement system is integral to developing a successful vocational training program. **S.B.E. Rule 229.551 (3)(g)** requires 70 percent placement of students who have completed a vocational training program. Although placement is not always a problem, as with students already working in a related occupation, the placement program should place emphasis upon students who are seeking entry-level employment since these students have little or no experience with industry.

The task of the placement program is to locate job openings in the community. The placement coordinator or teacher must know each student's personal aims and interests in addition to the information stated on the achievement record. In many cases, teachers are the best source to match students to job openings because of their contacts with the industry advisory committee. Input concerning employment openings must come from individual business establishments in the community. The placement coordinator should introduce a student to as many suitable job openings as possible. Conversely, employers can then be expected to interview as many qualified candidates as possible.

Cooperative Education

COOPERATIVE EDUCATION APPLICABILITY

Normally, a student will complete the entire program as a full-time student before obtaining employment as a communications technician. However, there may be situations where a student could be allowed to complete part of the program while employed as a communications technician. At this time it is appropriate for the student to enroll in industrial cooperative education (ICE). Guidelines for this training plan are provided in the "Industrial Cooperative Education Program Guide," published by the Division of Vocational, Adult, and Community Education, Order # IE 508 BK 87.

Industrial cooperative education is a method of instruction designed to prepare students for jobs in the community. This method is a joint effort between the school and the business community. Student trainees receive a combination of instruction in the classroom and related on-the-job training through employment. Learning experiences are jointly planned and supervised by the teacher and the employer. Cooperative education is relevant to the needs of the student preparing for a work role, and will help the student to achieve success and personal satisfaction as the transition is made from school to the constantly changing world of work.

Cooperative education is defined in the Federal Register, Volume 39, number 143, Vocational Education, Section 102.96, as a program ". . . to prepare students for employment, through: (a) providing meaningful work experiences combined with formal education enabling students to acquire knowledge, skills, and appropriate attitudes, (b) removing the artificial barriers which separate work and education, (c) involving educators with employers, creating interaction whereby the needs and problems of both are made known, thereby making it possible for occupational curricula to be revised to reflect current needs in various occupations . . . ."

PURPOSE

Cooperative Education is for persons who, through written cooperative arrangements between the school and employers, receive instruction, including required academic courses and related instruction by alternation of study in school with a job in any industrial occupational field. These two experiences must be planned and supervised by the school and employers so that each contributes to the student's education and employability. Work periods and school attendance may be on alternative half days, full days, weeks or other periods of time to fulfill objectives of the cooperative education program.

GOALS AND OBJECTIVES

The primary goal of the cooperative method of vocational education is to prepare skilled, responsible individuals who can assume a productive role in the community. Specific objectives to meet the primary goal are:

- To prepare individuals for employment, adjustment and advancement in specified occupations or occupational areas (primary objective)
- To provide an understanding of the contribution of work to the social and economic welfare of our nation
- To provide students with an understanding and appreciation of the American free enterprise system
- To foster an awareness of the civic, social and moral responsibilities of individuals to society

- To stimulate students' interest in their chosen occupational fields and provide an understanding of the opportunities in each field
- To provide training that results in increased efficiency in performing job tasks
- To provide curriculum which is sensitive and adaptable to changes in occupational practices and procedures as they are affected by societal, economic, technical and educational developments
- To strive to develop a greater appreciation of the value of specifically trained personnel among employers, employees and consumers
- To reinforce skills learned in the school laboratory
- To provide experiences on tools and equipment not available in the school laboratory
- To supplement and broaden the school curriculum into areas not otherwise available

Student Organization Participation

Vocational student organizations operate pursuant to federal and state laws, which authorize them as viable components of vocational education programs. According to federal regulations, the vocational education program of instruction may include activities of vocational student organizations which are an integral part of the vocational instruction offered and which are supervised by vocational education personnel. The **S.B.E.** Rules authorize vocational student organizations as an integral part of the vocational education program as stated in **S.B.E. 6A-6.064 (7)** and **6A-6.065 (8).**

VOCATIONAL INDUSTRIAL CLUBS OF AMERICA (VICA)

VICA is an organization for secondary or postsecondary students enrolled in trade and industrial education programs in high schools, area vocational technical centers and junior and community colleges. It is the only national and international organization for trade and industrial students. The organization is designed to expand and enrich opportunities for leadership, social awareness and civic responsibility in vocational students.

Students who participate in VICA activities are often better prepared for the world of work. They acquire knowledge of the many opportunities available in their chosen careers and become aware of the value of their

contributions to society. They are also given opportunities to develop and utilize their talents and abilities in ways that otherwise would not be available to them.

BENEFITS OF VICA MEMBERSHIP FOR THE STUDENT

Membership in VICA offers the student the opportunity for growth and development in the following areas:

School and Community Service Activities Students in VICA become involved in various school and/or community services. These may include clothing or food collections for the needy, donation of time and service to the elderly and participation in fund raisers or similar activities.

Social Interaction with Fellow Students Activities are also available that offer students time for relaxation and fun. Social activities of this type may be held on a regular basis. They might be held on the school campus during school hours, or off campus after school. More formal functions would include end of the year award banquets or industry/employer appreciation dinner banquets.

Competition in Skill and Leadership Contests VICA offers various contests in all the skill and leadership areas it serves. Often, teachers identify talented students who represent their school in regional competitions. However, any student member of VICA may compete. Instructors should conduct planned contests within their trade areas. This also pertains to leadership areas. First and second place regional winners then move on to the state level contest. The state winners then compete at the national level of the United States Skill Olympics.

INSTRUCTIONAL RESOURCES

STUDENT REFERENCE MATERIALS

Necessary instructional texts or pertinent material should be available for each student to satisfy training objectives. When textbooks are used, the copyright date should be as current as possible.

SERVICE MANUALS

Manuals with current manufacturer's service procedures and specifications should be available. These manuals must be located where students can use them while working in the shop area.

PERIODICALS

Current general and technical magazines and newspapers should be available for student and instructor use.

The following list of suggested resources is organized under each outcome shown in the curriculum framework. These resources have been recommended by instructors and program administrators.

01.0 DEMONSTRATE PROFICIENCY IN AMPLITUDE MODULATED RADIO TRANSMITTER AND RECEIVER SYSTEMS

TITLE, AUTHOR, ORDER#	PUBLISHER	TYPE
Fundamentals of AC Circuit Analysis	ADVANCED MICROSYSTEMS TECHNOLOGY	software
Fundamentals of Basic Electricity	ADVANCED MICROSYSTEMS TECHNOLOGY	software
Fundamentals of DC Analysis	ADVANCED MICROSYSTEMS TECHNOLOGY	software
AM Transistorized Radio Morris Tischler SIP327M	SCIENCE INSTRUMENTS COMPANY	text
Audio Power Transistorized Amplifier Morris Tischler SIP326M	SCIENCE INSTRUMENTS COMPANY	text
Electronic Communications Thomas Adamson	DELMAR PUBLISHING	text
Miller's Modem Electronic Communication, Third Edition Mark E. Oliver	PRENTICE-HALL, Division of Simon & Schuster	text
Modern Electronic Communications, Third Edition Garry Miller	PRENTICE-HALL, Division of Simon & Schuster	text
Radio Communications Electronics series 205	NIDA CORPORATION	text
Transceiver NIDA Trainer Model 205	NIDA CORPORATION	text

Troubleshooting, Servicing and Theory of AM, FM and FM Stereo Receivers Clarence Green	PRENTICE-HALL, Division of Simon & Schuster	text

02.0 DEMONSTRATE PROFICIENCY IN DOUBLE SIDE BAND AND SINGLE BAND RADIO SYSTEMS

TITLE, AUTHOR, ORDER#	PUBLISHER	TYPE
AM/Double Side Band Suppressed Carrier Transmitter Morris Ticshler SIP350M	SCIENCE INSTRUMENTS COMPANY	text
Advanced Communications Electronics	NIDA CORPORATION	text

03.0 DEMONSTRATE PROFICIENCY IN FREQUENCY MODULATED RADIO TRANSMITTER AND RECEIVER SYSTEMS

TITLE, AUTHOR, ORDER#	PUBLISHER	TYPE
Fundamentals of Operational Amplifiers	ADVANCED MICROSYSTEMS TECHNOLOGY	software
Fundamentals of Regulated Power Supplies	ADVANCED MICROSYSTEMS TECHNOLOGY	software
FM Stereo Radio Morris Tischler SIP328M	SCIENCE INSTRUMENTS COMPANY	text
FM Transmitters Morris Tischler SIP355M	SCIENCE INSTRUMENTS COMPANY	text

04.0 DEMONSTRATE PROFICIENCY IN HIGH FREQUENCY AM AND FM TWO-WAY RADIO SYSTEMS

TITLE, AUTHOR, ORDER#	PUBLISHER	TYPE
Fundamentals of Digital Circuits	ADVANCED MICROSYSTEMS TECHNOLOGY	software
Antennas and Transmission Lines Morris Tischler SIP360M	SCIENCE INSTRUMENTS COMPANY	text
Integrated Circuit and Logic Fundamentals MAV-PAC XXA	MOTOROLA COMMUNICATIONS AND ELECTRONICS, INC.	text
Motorola Micor Hi-Band FM Two-Way Business Radio MAV-Pack TMA Micor T43-T73 RTN	MOTOROLA COMMUNICATIONS AND ELECTRONICS, INC.	text/ slides
Antenna Theory AQT-090-1	SCIENCE INSTRUMENTS COMPANY	video
Antennas AQT-090-2	SCIENCE INSTRUMENTS COMPANY	video

05.0 DEMONSTRATE PROFICIENCY IN MICROWAVE SYSTEMS

TITLE, AUTHOR, ORDER#	PUBLISHER	TYPE
Microwave Communications S365-34	SCIENCE INSTRUMENTS COMPANY	audio tapes
Active Microwave Devices AQT-122-2	SCIENCE INSTRUMENTS COMPANY	slides
Microwave Engineering I AQT-122-3	SCIENCE INSTRUMENTS COMPANY	slides

Microwave Engineering II AQT-122-4	SCIENCE INSTRUMENTS COMPANY	slides
Microwave Communications Morris Tischler SIP366M	SCIENCE INSTRUMENTS COMPANY	text
Microwave Communications SIP365	SCIENCE INSTRUMENTS COMPANY	video

06.0 DEMONSTRATE PROFICIENCY IN SATELLITE SYSTEMS

TITLE, AUTHOR, ORDER#	PUBLISHER	TYPE
Satellite Communications Morris Tischler SIP368M	SCIENCE INSTRUMENTS COMPANY	text
Installing Satellite Antennas SIP369-5	SCIENCE INSTRUMENTS COMPANY	video

07.0 DEMONSTRATE PROFICIENCY IN VIDEO SYSTEMS

TITLE, AUTHOR, ORDER#	PUBLISHER	TYPE
Video Cameras: Theory & Servicing Gerald P. McGinty UVB-328E	VALIANT, INC.	text

08.0 DEMONSTRATE PROFICIENCY IN COMMERCIAL AUDIO SYSTEMS

TITLE, AUTHOR, ORDER#	PUBLISHER	TYPE
Communications Standards Dictionary Martin H. Welk	VAN NOSTRAND REINHOLD COMPANY, INC.	text
Electronic Communications Shrader	McGRAW-HILL BOOK COMPANY	text
Microphones Martin Clifford UVB-475E	VALIANT, INC.	text
Sound System Engineering Don Davis	HOWARD W. SAMS AND COMPANY, Division of Macmillan, Inc.	text

09.0 DEMONSTRATE PROFICIENCY IN DATA COMMUNICATIONS

TITLE, AUTHOR, ORDER#	PUBLISHER	TYPE
Integrated Optics AQT-119	SCIENCE INSTRUMENTS COMPANY	audio tapes
PCM Communications SIP397A/C	SCIENCE INSTRUMENTS COMPANY	slides
Data Communications William L. Schweber	McGRAW-HILL BOOK COMPANY	text
Digital Communications Morris Tischler SIP397M	SCIENCE INSTRUMENTS COMPANY	text
Optoelectronics, Fiber Optics Communications Morris Tischler SIP375M	SCIENCE INSTRUMENTS COMPANY	text

10.0 DEMONSTRATE PROFICIENCY IN FIBER OPTIC COMMUNICATIONS SYSTEMS

TITLE, AUTHOR, ORDER#	PUBLISHER	TYPE
Understanding Lightwave Transmission: Applications of Fiber Optics William O. Grant	HARCOURT BRACE JOVANOVICH	text

PUBLISHERS' ADDRESSES

ADVANCED MICROSYSTEMS TECHNOLOGY
Post Office Box 1942
Bowling Green, KY 42102

DELMAR PUBLISHING
2 Computer Drive West
Albany, NY 12212
518-459-1150

HARCOURT BRACE JOVANOVICH
6277 Sea Harbor Drive
Orlando, FL 32887-0001
407-345-2000

HOWARD W. SAMS AND COMPANY,
Division of Macmillan, Inc.
4300 West 62nd Street
Indianapolis, IN 46268
800-428-7267

MERRILL PUBLISHERS
1300 Alum Creek Drive
Columbus, OH 43216
800-848-6205

MOTOROLA COMMUNICATIONS AND ELECTRONICS, INC.
2604 West 9th Street
Witchita, KS 67203-4792
316-832-0121

McGRAW-HILL BOOK COMPANY
1221 Avenue of the Americas
New York, NY 10020
212-512-2000

NIDA CORPORATION
300 South John Rodes Boulevard
Melborne, FL 32900

PACE, INC.
9893 Brewers Court
Laurel, MD 20707

PRENTICE-HALL,
Division of Simon & Schuster
Route 9 West
Englewood Cliffs, NJ 07632
201-592-2000

SCIENCE INSTRUMENTS COMPANY
6122 Resisterstown Road
Baltimore, MD 21215
301-358-7810

VALIANT, INC.
195 Bonhomme Street
Post Office Box 488
Hackensack, NJ 07602

VAN NOSTRAND REINHOLD COMPANY, INC.
7625 Empire Drive
Florence, KY 41042
606-525-6600

FACILITIES

Facility Design Recommendations

Facilities, tools and equipment are essential parts of training programs, and must be designed to meet State program standard requirements and instructional objectives. This section of the Program Guide contains information for setting up classroom and laboratory facilities. Facility design criteria and space requirements are specified in **S.B.E. Section B, Chapter 6A-2**.

TEACHING FACILITIES

The instructional environment should duplicate, as closely as possible, the real-life work environment the student will enter after graduation. The more the school resembles the industrial environment, the easier it will be for the student to make the transition from school to work. Tools, supplies and equipment should conform to local industry standards. The teacher should actively pursue supplemental resources to expose the students to state-of-the-art equipment.

All facilities should include classroom space, as well as space for regular classroom equipment such as audio-visual equipment. Laboratory facilities should be equipped with work stations or workbenches, tables, chairs and special training aids to demonstrate basic principles and theory. They should contain enough tools and equipment to enable several students to work individually on the same learning activity.

UPDATING FACILITIES

To keep pace with technological changes and improvements, facilities must be updated on a continuing basis. When planning facilities, priority must be given to provide space which will fulfill changing needs of the instructional program. Buildings should be designed with flexibility to expand in order to accommodate future program changes and to allow for greater ease of facility updating. The program advisory committee should be used to assist the school in establishing priorities for obtaining facilities, tools and equipment. Careful planning and analysis of current and future needs will lead to the establishment of an effective training environment.

SCHOOL FACILITIES

Communication Electronics Classroom/Laboratory Areas

This section of the program guide provides guidelines for Communication Electronics program facilities. All vocational programs must meet additional facility requirements specified in **S.B.E. Section B, Chapter 6 A-2.**

Laboratory facilities for this program must accommodate a variety of communications equipment. Work stations are needed to analyze and troubleshoot radios, microwave equipment, data communications systems, fiber optic systems, audio and video equipment and satellite system components. Access to the roof of the building is necessary to set up antennas for communications systems and run antenna cables into the lab.

The laboratory should include electrical outlets providing 110 volts at each work station. Electrical outlets should be permanently mounted to the work station benches. Additional electrical outlets should be installed along the walls and in the center areas of the laboratory. Electrical outlets in the center areas should be mounted on posts between the ceiling and work stations or on pull down extension systems. Special electrical wiring may be required to supply the power requirements of specialized equipment. All electrical service must be installed according to local building code requirements.

CLASSROOM/LABORATORY FACILITIES

Space requirements for **new** facility construction for this program are specified in **S.B.E. Rule 6A-2.032** as shown below.

NEW FACILITIES COMMUNICATION ELECTRONICS	
Occupant Design Stations	20
Net Square Feet Per Occupant	
Minimum	54
Normal	57
Maximum	59
Total Net Square Feet	
Minimum	1080
Normal	1140
Maximum	1180

WORK STATION ARRANGEMENT

The arrangement of work stations and specialized equipment depends upon the general layout of the facilities, but careful consideration must be given to convenience to entrances and exits, easy movement among work stations and tool/storage areas. The area should have a counter convenient to work stations. Overall layout of the facility should be planned so that the location of entrances and exits permits a logical flow of work in progress. One of the most critical factors in planning a facility is the arrangement of work stations to obtain a safe, efficient traffic pattern.

ADDITIONAL FACILITY CONSIDERATIONS

Training Stations

Training stations and live work areas must be available in the type and number required to meet program goals and performance objectives.

Instructional Area

A classroom or designated area of the laboratory should be available for lecture, instruction, viewing audio visual materials and other nonshop activities.

Personal Tool/Equipment Storage Area

A secure storage room or area should be provided, with enough shelf space for student supplies/tool boxes and floor space for equipment.

General Storage

Storage areas for tools, parts, supplies and machines must be sufficient to support the activities outlined in the program goals and performance objectives.

Office Space

An area separate from the classroom and laboratory should be available and convenient for use by the instructor(s) as an office.

Maintenance

A regular facilities maintenance program must be implemented to ensure that equipment and facilities are safe and usable to meet instructional needs.

Housekeeping

The classroom, laboratory and support area(s) must be kept clean and orderly.

Ventilation

A fume/dust removal system should be in place and operable. When appropriate, heating and cooling systems should be used to provide sufficient comfort for learning. Ventilation requirements are stated in **S.B.E. Rule 6A-2.066.**

First Aid

A first aid station must be in place, well marked and complete with appropriate supplies.

Support Facilities

Restrooms, clean-up areas and lockers convenient to the shop should be available for students.

Safety

The facilities must meet all Occupational Safety and Health Administration (OSHA) safety standards, where applicable.

Facility Evaluation

The program advisory committee should be asked to conduct an annual evaluation of the facilities to ensure the program's continuing capability to meet instructional objectives.

Safety, Maintenance and Liability

SAFETY

S.B.E. Rule 6A-2.097

The Florida State Board of Education establishes rules for the operation of public schools. **Part III, Section B, Chapter 6A-2** of the State Board of Education Rules contains the standards for existing educational facilities. Subsections deal with the entire school facility in regard to such topics as electrical equipment, flammable materials, ventilation, fire safety, storage and illumination. Subsection 6A-2.097 contains safety regulations pertaining to vocational classes.

The statute requires 100 percent protection of every student and teacher participating in laboratory work wherein the type of activities listed in the statute above are conducted. This will include: demonstration by teachers or students, students and teachers present in a room or laboratory when students are engaged in make-up work or project work, and when anyone is using tools for construction or repair work involving the shaping or cutting of any solid materials.

Rules and regulations for an eye protection program should be organized and distributed to teachers, students and school personnel. Safety devices should be worn by those participating in the activity and by those who are observers or who may be in close proximity.

Electrical safety hazards present in electrical or electronics shops include the possibility of electric shock, touching hot electrical components, being hit by sparks or materials from exploding electrical components, or injury from high power radio transmitters.

Special instructions should be provided to students concerning the following safety hazards.

1. Electric shock
   A. How to avoid electrical shock
   B. What to do for individuals who are subjected to electrical shocks

2. Burns
   A. How to identify and handle hot electrical components
   B. Treatment of minor burns

3. Exploding materials
   A. Causes of explosions and types of components likely to explode
   B. Protection from flying materials

4. Radio transmission injury
   A. Types of potential injury from radio transmitters
   B. Protective measures to avoid injury from radio transmitters

Marking of Hazardous Areas

Floors, walls, posts, stationary objects, machinery and equipment should be properly painted, marked, coded or identified, according to recommended safety practices of OSHA, the school board and industry.

Emergency Procedure For Injuries

The following procedures are recommended in the event of an injury or sudden illness in a student:

- Refer to the red "fire or medical emergency" signs posted in appropriate areas.
- Provide immediate first aid if so qualified.
- Notify appropriate personnel to advise them of the problem. They can also contact emergency trained personnel on campus.

- A conscious person has the right to refuse treatment and/or transportation to a medical facility.
- Advise students that they will be financially responsible for ambulance and emergency care.
- The paramedics will assume patient care upon arrival.
- If emergency transportation is not indicated, the student may spend time at the clinic, be allowed to go home or go to a medical facility.
- Be sure to complete the appropriate student injury form for any and all accidents or sudden illness.

MAINTENANCE

Schools should have the necessary facilities for routine maintenance. Special maintenance requirements for this program concern the hand and power tools and machines. Arrangements must be made to accomplish routine and non-routine maintenance of hand and power tools and cutting and shaping machines. Arrangements can be made through the school's shop or an outside agency.

VOCATIONAL TEACHER LIABILITY

Liability of Teacher and School Board

Negligence of vocational education teachers can cause unnecessary injury, and may result in teacher and school district liability. Vocational teachers are recommended to carry personal liability insurance. To reduce the risk of liability and injuries, the following suggestions are provided.

- Follow accepted policies of the school board.
- Do not allow students to use equipment or tools which have not been approved by the administration and Board of Education.
- Establish safety rules and enforce them.
- Do not leave the shop/laboratory while students are working.
- Do not permit non-enrolled students to use the shop/laboratory.
- Do not allow students to use machines or tools for which instruction has not been given.
- Do not approve unsupervised student activities inside or outside

the shop/laboratory.

- Prepare accident forms for all accidents.
- Regularly inspect the workplace and equipment for defects or potential hazards and maintain documentation of unserviceable or hazardous items.
- Consider age, maturity, skill and ability of students when providing instruction and supervision.
- Administer safety tests to students upon completion of the demonstration of a specific machine, tool or process and keep documentation on file in your office.
- Require all students to wear eye protection devices, when appropriate, for laboratory activities.

SUGGESTED EQUIPMENT LIST

General Classroom Equipment

DESCRIPTION

Chalkboard

Bulletin board

Bookcases

Cabinet-storage

Student study stations

Audio-visual equipment as needed

Laboratory Tools and Equipment

These tools and items of equipment are normally used in this program. Equipment items are listed under each outcome, corresponding to the curriculum framework. Consumable supplies should be readily available to assure continuous instruction. Consumable supplies such as solder and wire are not contained in the equipment list.

01.0	DEMONSTRATE PROFICIENCY IN AMPLITUDE MODULATED RADIO TRANSMITTER AND RECEIVER SYSTEMS

DESCRIPTION

Communication systems analyzer (Motorola R2400 or equivalent) to perform functions of AM/FM signal generator, distortion meter, multipurpose oscilloscope, multimode code synthesizer and spectrum analyzer
Heat sinks
Lab trainer system (NIDA 205 or equivalent) for radio communications

Lab trainer system (SIP360 antennas, SIP361C UHF antennas, Science Instruments or equivalent)
Meter, field strength
Probe, RF
Probe, high-voltage
Soldering station, temperature controlled, grounded tip type, tip temperature 500F to 600F, or low wattage (25 to 35W)
Tracer, signal, audio and RF

02.0 DEMONSTRATE PROFICIENCY IN DOUBLE SIDE BAND AND SINGLE BAND RADIO SYSTEMS

DESCRIPTION

Dummy load
Lab trainer system (SIP 350 Science Instruments or equivalent) for double side band radio systems

03.0 DEMONSTRATE PROFICIENCY IN FREQUENCY MODULATED RADIO TRANSMITTER AND RECEIVER SYSTEMS

DESCRIPTION

Lab trainer system (Lab Volt model 8080 or equivalent) for FM radio transmitter
Lab trainer system (SIP 328 D Science Instruments or equivalent) for FM stereo radio receiver
Meter, deviation

04.0 DEMONSTRATE PROFICIENCY IN HIGH FREQUENCY AM AND FM TWO-WAY RADIO SYSTEMS

DESCRIPTION

FM receiver (Motorola or equivalent)
FM two way radio (Motorola MAXAR 80 model or equivalent) for pagers, repeaters and mobile phones

05.0 DEMONSTRATE PROFICIENCY IN MICROWAVE SYSTEMS

DESCRIPTION

Lab trainer system (SIP 365 Science Instruments or equivalent) for microwave waveguide

06.0 DEMONSTRATE PROFICIENCY IN SATELLITE SYSTEMS

DESCRIPTION

Lab trainer system (SIP 369 Science Instruments or equivalent) for VHF satellite system
Lab trainer system (SIP 369-1 Science Instruments or equivalent) for satallite receiver
Lab trainer system (SIP 369-2 Science Instruments or equivalent) for signal processor

07.0 DEMONSTRATE PROFICIENCY IN VIDEO SYSTEMS

DESCRIPTION

Adapter, input, video/audio, with remote switch
Cable, video/audio, output
Chart, NTSC, color bar
Chart, NTSC, gray scale
Chart, auto focus
Chart, back focus
Degausser coil
Digital IC color generator analyst (band K 1248 digital color bar generator or equivalent)
Driver, back focus adjustment
Driver, special (3MM diam., 6 in. long)
Test tape, in color bars
Test tape, monoscope
Test tape, multiburst

08.0 DEMONSTRATE PROFICIENCY IN COMMERCIAL AUDIO SYSTEMS

DESCRIPTION

FET volt meter
Intermodulation distortion analyzer
Public address system, commercial type, with speakers, microphone & power amplifier or equivalent
Sound level meter

09.0 DEMONSTRATE PROFICIENCY IN DATA COMMUNICATIONS

DESCRIPTION

Lab training system (Lab Volt models AS19477, AS19481, AS19483, AS19479, AS19476 or equivalent)
Lab training system (SIP 397 Science Instruments or equivalent) for digitial communication prewired panels

10.0 DEMONSTRATE PROFICIENCY IN FIBER OPTIC COMMUNICATIONS SYSTEMS

DESCRIPTION

Fiber optic lab training system (Lab Volt AS19485 or equivalent)
Lab training system (SIP 375 Science Instruments or equivalent) for optoelectronics, fiber optics communications

LICENSURE AND CREDENTIALING

Licensure

Program completers should obtain a Federal Communication Commission (FCC) license for activities involving the operation, repair or adjustment of commercial radio transmission equipment. FCC license requirements are specified in the **Code Of Federal Regulations, Title 47, Chapter 1.**

Commercial radio operators licenses are classified in **Chapter 1, Part 13.2,** as follows:

1. First Class Radiotelegraph Operator's Certificate.
2. Second Class Radiotelegraph Operator's Certificate.
3. Third Class Radiotelegraph Operator's Certificate.
4. General Radiotelephone Operator License.
5. Marine Radio Operator Permit.
6. Restricted Radiotelephone Operator Permit.

Credentialing

There are no other specific credentialing requirements for program completers. However, it is recommended that communication electronics technicians maintain membership in professional associations such as those listed in this guide. Employers will recognize a membership card from a professional organization as an indication of professional certification.

PROFESSIONAL DEVELOPMENT

Teacher Technical Updating

Technical updating workshops are scheduled periodically throughout the State, usually in the summer months. Teachers should take advantage of the opportunity to attend the Communication Electronics program technical update workshops when they are held. All instructional staff are encouraged to participate in as many training opportunities as possible.

Teachers should seek opportunities with local companies to maintain currency with industry trends. During periods when school is not in session, teachers are encouraged to make arrangements to return to industry for suitable involvement in their area of expertise.

Membership in professional associations offers vocational educators an enormous range of opportunities for working together to strengthen the field and to develop personal competence and satisfaction in work. The associations have similar goals and activities. They seek excellence in program content by means of joint efforts among members, communications that keep members current, forums for the discussion of issues in the field, useful and stimulating publications and sound professional growth experiences at local, state, regional and national meetings and annual conventions. They are concerned with increasing public understanding and support of the field. Teachers are encouraged to maintain affiliation with professional organizations. A list of professional organizations follows this section of the guide.

Teacher Standards

As a prerequisite to certification, teachers must have the required years of experience in the appropriate technical field as defined in the certification standards. For the Communication Electronics program, the requirements are six years continuous experience in communication electronics. The teacher is then judged qualified to teach upon meeting one of the following criteria: (1) regular or temporary Florida teacher's certificate with appropriate coverage, (2) approval of local school board consistent with adopted school policy or (3) regular or temporary Florida teacher's certificate with other than appropriate coverage (has met all occupational experience requirements prescribed as a prerequisite to appropriate certification and has been approved by the school board to teach

out-of-field). Refer to the Curriculum Framework for this program to determine the appropriate occupational specialization coverage required for certification.

Instructional staff must have technical competency and meet all State and local requirements for certification. Instructors should hold current, nationally recognized certification in the subject areas taught, if awarded. Beginning teachers must be enrolled in the State Beginning Teacher Program.

Communication Electronics instructors should hold a Federal Communications Commission (FCC) license. FCC license requirements are specified in the Code of Federal Regulations, Title 47, Chapter 1.

An amateur radio station license will not be issued to schools, but teachers may receive an amateur radio station license for personal use. See Chapter 1, Part 97.39, Code of Federal Regulations, for further information.

A systematic method of obtaining "substitute" instructors, approved by the school board, should be used to assure instructional continuity. An orientation session for substitutes should be held on a regular basis. The substitute should be a competent instructor in the occupational area and specific competencies taught.

Professional Organizations and Support Services

EDUCATION ORGANIZATIONS

AMERICAN VOCATIONAL ASSOCIATION (AVA)
1410 King Street
Alexandria, VA 22314
800-826-9972

FLORIDA ASSOCIATION FOR TRADE AND INDUSTRIAL EDUCATION, INC. (FATIE)
Florida Department of Education
Industrial Education - Vocational Division
Knott Building
Tallahassee, FL 32399
904-488-0484

FLORIDA VOCATIONAL ASSOCIATION (FVA)
1420 North Paul Russell Road
Tallahassee, FL 32399
904-878-6860

FLORIDA VOCATIONAL INDUSTRIAL CLUBS OF AMERICA (VICA)
Florida Department of Education
Knott Building
Tallahassee, FL 32399
904-488-0484

TRADE ORGANIZATIONS

This list contains trade associations and technical societies. Many offer training programs of some sort, either directly or through their member companies. Specific details should be requested in writing.

ARMED FORCES COMMUNICATIONS AND ELECTRONICS ASSOCIATION (AFCEA)
4400 Fair Lakes Court
Fairfax, VA 22033-3899
703-631-6178

NATIONAL ASSOCIATION OF RADIO AND TELECOMMUNICATIONS ENGINEERS (NARTE)
Post Office Box 15029
Salem, OR 97309
503-581-3336

ELECTRONIC INDUSTRIES ASSOCIATION
2001 Eye Street, Northwest
Washington, DC 20006
202-457-4900

IEEE COMMUNICATIONS SOCIETY
c/o INSTITUTE OF ELECTRICAL AND ELECTRONIC ENGINEERS
345 East 47th Street
New York, NY 10017
212-705-7867

COMPUTER AND COMMUNICATIONS INDUSTRY ASSOCIATION
666 11th Street, Northwest
Washington, DC 20001
202-783-0070

ASSOCIATION OF COMMUNICATIONS TECHNICIANS
(also) NATIONAL ASSOCIATION OF BUSINESS AND EDUCATIONAL RADIO
Alexandria, VA 22314
703-739-0300

CELLULAR TELECOMMUNICATIONS INDUSTRY ASSOCIATION
1990 Elm Street, Northwest, Suite 610
Washington, DC 20036
202-785-0081

NATIONAL SOUND AND COMMUNICATIONS ASSOCIATION
501 West Algonquin Road
Arlington Heights, IL 60005
312-593-8360

COMPUTER AND BUSINESS EQUIPMENT
MANUFACTURING ASSOCIATION (CBEMA)
311 First Street, Northwest, 5th Floor
Washington, DC 20001
202-737-8888

COMPUTER AIDED MANUFACTURING INTERNATIONAL (CAM-I)
611 Ryan Plaza Drive, Suite 1107
Arlington, TX 76011
817-860-1654

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION
2101 L Street, Northwest, Suite 300
Washington, DC 20037
202-457-8400

AMERICAN ELECTRONIC ASSOCIATION (AEA)
2680 Hanover Street
Palo Alto, CA 94304
408-720-0117

ELECTRONICS TECHNICIANS ASSOCIATION, INTERNATIONAL (ETA-I)
604 North Jackson
Greencastle, IN 46135
317-653-8262

INSTITUTE FOR INTERCONNECTING AND PACKAGING
ELECTRONIC CIRCUITS (IPC)
7380 North Lincoln Avenue
Lincolnwood, IL 60646
312-677-2850

INTERNATIONAL SOCIETY OF CERTIFIED ELECTRONICS
TECHNICIANS (ISCET)
2708 West Berry, Suite #8
Fort Worth, TX 76109
817-921-9101

JOINT ELECTRONIC DEVICE ENGINEERING COUNCIL (JEDEC)
2001 Eye Street, Northwest
Washington, DC 20006
202-457-4971

NATIONAL ELECTRONIC SERVICE DEALERS ASSOCIATION (NESDA)
2708 West Berry Street
Fort Worth, TX 76109
817-921-9061

SEMICONDUCTOR EQUIPMENT AND
MATERIALS INTERNATIONAL (SEMI)
805 East Middlefield Road
Mountain View, CA 94043
415-964-5111

SEMICONDUCTOR INDUSTRY ASSOCIATION (SIA)
10201 Torre Avenue, Suite 275
Cupertino, CA 95014
408-973-9973

State of Florida
Department of Education
Tallahassee, Florida
Betty Castor, Commissioner
Affirmative action/equal opportunity employer

IE563 BK-91

CAREER MERIT ACHIEVEMENT PLAN
(CAREER MAP)

COMMUNICATION ELECTRONICS

(0647.010300)

STUDENT'S NAME

State of Florida

An affirmative action/equal opportunity employer

DEPARTMENT OF EDUCATION
Betty Castor, Commissioner of Education

DIVISION OF VOCATIONAL, ADULT AND COMMUNITY EDUCATION
Robert S. Howell, Director

DEVELOPED BY:
University of South Florida
Department of Adult and Vocational Education

INDUSTRY-BASED PARTNERSHIP PROGRAMS: The State of Florida is committed to the development of industry-based partnership programs, designed by education and industry to respond to industry's demand for a highly skilled work force.

ACKNOWLEDGEMENTS

PARTNERSHIP WITH INDUSTRY

The following industry representatives are recognized, in addition to original industry members, for their valuable contributions to the identification and validation of the Communication Electronics competencies reflected in this MAP:

Mr. Michael Balbes, Microdyne Corporation
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Mr. John Dubone, Tallahassee Communications Corporation
Mr. Lawrence Elkin, Sea Coast Appliance Distributors, Inc.
Mr. Jack Freeman, Jack Freeman's, Inc.
Mr. Jimmy R. Hall, Tampa Electric Company
Mr. Jack E. Hooper, Brad Cable Electronics, Inc.
Mr. Ben Housden, Custom Repair Services, Interconics, Inc.
Mr. Edlin A. Jontra, Busch Entertainment Corporation
Mr. Frank Keller, General Telephone Company
Mr. Dan Lenhof, Stromberg-Carlson Corporation
Mr. Herman H. Lopez, Tampa Electric Company
Mr. Charles Phariss, Unisis, Inc.
Mr. Bob Wienski, Siemens Communications Systems, Inc.

For further information, contact
Bureau of Vocational Program and Staff Development
Division of Vocational, Adult, and Community Education
Department of Education
Knott Building
Tallahassee, FL 32399

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THIS MERIT ACHIEVEMENT PLAN RECORDS THE COMMUNICATION ELECTRONICS ACHIEVEMENTS OF:

Student's Name _____

Student ID Number _____

Student's Address _____

_____

Initial Instructor _____

School _____

Date Started _____

PRIMARY JOB TITLE(S) FOR COMMUNICATION ELECTRONICS

- Communication Technician

Program completers qualify for the primary job title(s) listed above. Related job titles may be added based on those job titles found in industry and/or the Dictionary of Occupational Titles.

OVERVIEW

This Career MAP includes the competencies required for entry into the field of communication electronics. Business and industry representatives have recommended that students in this field master these competencies in order to become employable. Local education agencies (LEAs) may adapt these competencies to meet their workforce needs.

PURPOSE OF THE MAP

The purposes of the MAP are: to display the student performance standards (SPS) required by the LEA and to document the level of achievement on student performance standards that the student demonstrates.

HOW TO USE THE MAP

Administrator and Instructor. The administrator and instructor can use Career MAPs in curriculum planning, program updating and improvement and teacher recruitment, selection and updating. If the LEA changes or adds student performance standards, the revised or additional student performance standards should be included in the blank boxes that appear within each intended outcome or at the end of this MAP.

Instructor. The instructor can use Career MAPs to keep track of student progress on student performance standards. By periodically reviewing the ratings on student performance standards, the instructor can identify a student's strengths and weaknesses and, on that basis, identify the skills for which the student needs remedial instruction or advanced training. The MAP can also be useful in student counseling and evaluation.

Co-op Instructor/Employer. The employer who sponsors a co-op program should use the Career MAP for keeping a record of the student's performance on appropriate standards. The MAPs will also help the co-op instructor/employer in counseling and evaluating the student.

Student. The student may use the MAP to show potential employers the performance standards he or she has mastered. In order to present a complete record, the student should encourage the instructor/co-op employer to rate his or her level of achievement on all the appropriate student performance standards and to fill in the verification form/cooperative work experience page in the back of this MAP.

Employer. The MAP shows an employer the student performance standards mastered by the student (a prospective employee) and the proficiency level achieved on each student performance standard. This information can help the employer make decisions about hiring, job assignments and job-training needs.

RATING STUDENT PERFORMANCE STANDARDS

Performance Competencies. Ratings on student performance standards should be based upon business/industrial performance standards. The evaluator observes and evaluates student performance as he or she would in the role of the employer or supervisor.

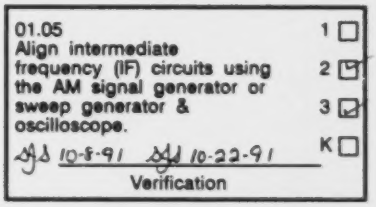
For each skill listed the learner receives a rating of 1, 2 or 3. Each rating indicates a particular level of achievement:

1 = Learner demonstrates knowledge and understanding of this student performance standard, but is not yet able to apply that knowledge or understanding.

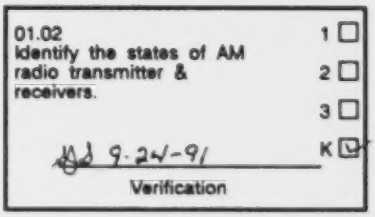
2 = Learner performs this student performance standard satisfactorily with only periodic supervision.

3 = Learner performs this student performance standard satisfactorily without supervision.

Whenever a performance standard is demonstrated, the instructor checks the appropriate rating box (1, 2 or 3) and initials and dates the verification line. If the student later demonstrates a higher level of achievement on a performance competency, the instructor checks the higher level and then enters his or her initials and the new date on the verification line, as shown in the following example:



Knowledge Competencies. For each SPS that is a knowledge competency only, with no manipulative skill involved, only one level of achievement is possible. If the student masters the competency, he or she receives a check in the bottom box ("K"), as shown below:



NOTE: A student performance standard without a checked rating indicates that the learner has not mastered the standard from lack of either ability, time, opportunity or need (the student's area of specialization may not have required it).

01.0 DEMONSTRATE PROFICIENCY IN AMPLITUDE MODULATED RADIO TRANSMITTER & RECEIVER SYSTEMS.

01.01 Describe the operation of amplitude modulated (AM) radio systems. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	01.02 Identify the stages of AM radio transmitters & receivers. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	01.03 Define principles of AM modulation. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification
01.04 Analyze & troubleshoot AM transmitter & receiver circuits to include mixers, IF amplifiers, local oscillators, modulators, demodulators & microphones. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	01.05 Align intermediate frequency (IF) circuits using the AM signal generator or sweep generator & oscilloscope. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	01.06 Measure the IF section bandwidth using a sweep generator & an oscilloscope or signal generator & a spectrum analyzer. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification
01.07 Measure input voltage sensitivity to the receiver using a signal to noise ratio meter or spectrum analyzer. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	01.08 Determine signal to noise ratio. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	01.09 Conduct operating systems checks of AM transmitter & receiver circuits & make minor adjustments. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification
01.10 Set up & adjust AM antenna systems using a power meter & standing wave ratio (SWR) meter. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	01.11 Analyze AM radio circuits using spectrum analyzers, noise analyzers impedance bridges, sweep generators, dummy loads & phase meters. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	01.12 Measure AM radio signals using power meters, field strength meters & distortion meters. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification
01.13 Analyze, troubleshoot & adjust AM heterodyning, frequency synthesis, phased locked looped, signal filtering & automatic control circuits. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	01.14 Analyze, troubleshoot & adjust radio frequency (RF) power amplifier circuits for AM radio transmitters. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	01.15 Analyze, troubleshoot & adjust AM stereo transmitter & receiver circuits. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification
1 ☐ 2 ☐ 3 ☐ K ☐ Verification	1 ☐ 2 ☐ 3 ☐ K ☐ Verification	1 ☐ 2 ☐ 3 ☐ K ☐ Verification
1 ☐ 2 ☐ 3 ☐ K ☐ Verification	1 ☐ 2 ☐ 3 ☐ K ☐ Verification	1 ☐ 2 ☐ 3 ☐ K ☐ Verification

02.0 DEMONSTRATE PROFICIENCY IN DOUBLE SIDE BAND AND SINGLE SIDE BAND RADIO SYSTEMS.

02.01 Describe the operation of double side band suppressed carrier (DSSC) radio systems. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	02.02 Identify the stages of DSSC radio transmitters & receivers. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	02.03 Analyze & troubleshoot DSSC transmitter & receiver circuits. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification
02.04 Conduct operating systems check of DSSC circuits & make minor adjustments. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	02.05 Describe the operation of single side band (SSB) radio systems. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	02.06 Identify the stages of SSB radio transmitters & receivers. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification
02.07 Analyze & troubleshoot SSB transmitter & receiver circuits. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	02.08 Conduct operating systems check of SSB circuits & make minor adjustments. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	02.09 Set up & adjust SSB & DSSC antenna systems using power meters & SWR meters. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification
02.10 Analyze or measure SSB & DSSC radio circuits using spectrum analyzers, noise analyzers, impedance bridges, sweep generators, dummy loads & phase meters. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	02.11 Analyze & measure SSB & DSSC radio signals using power meters, field strength meters & distortion meters. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	02.12 Analyze, troubleshoot & adjust SSB & DSSC heterodyning, frequency synthesis, phased locked looped, signal filtering & automatic control circuits. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification
02.13 Analyze, troubleshoot & adjust RF power amplifier circuits for SSB & DSSC radio transmitters. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	1 ☐ 2 ☐ 3 ☐ K ☐ Verification	1 ☐ 2 ☐ 3 ☐ K ☐ Verification
1 ☐ 2 ☐ 3 ☐ K ☐ Verification	1 ☐ 2 ☐ 3 ☐ K ☐ Verification	1 ☐ 2 ☐ 3 ☐ K ☐ Verification
1 ☐ 2 ☐ 3 ☐ K ☐ Verification	1 ☐ 2 ☐ 3 ☐ K ☐ Verification	1 ☐ 2 ☐ 3 ☐ K ☐ Verification

03.0 DEMONSTRATE PROFICIENCY IN FREQUENCY MODULATED RADIO TRANSMITTER & RECEIVER SYSTEMS.

03.01 Describe the operation of frequency modulated (FM) radio systems. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	03.02 Identify the stages of FM radio transmitters & receivers. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	03.03 Define principles of FM modulation. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification
03.04 Analyze & troubleshoot FM transmitter & receiver circuits. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	03.05 Align IF circuits using an FM signal generator & sweep generator. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	03.06 Measure IF section bandwidth using an oscilloscope or spectrum analyzer. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification
03.07 Measure receiver input voltage sensitivity to receiver antenna input using a signal to noise ratio meter or spectrum analyzer. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	03.08 Conduct operating systems check of FM transmitter & receiver circuits & make minor adjustments. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	03.09 Analyze & troubleshoot FM stereo transmitter, receiver & digital tuning circuits. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification
03.10 Conduct operating systems check of broad band FM stereo transmitter & receiver circuits & make minor adjustments. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	03.11 Analyze, troubleshoot & adjust the standard FM right & left channel subcarrier & the subsidiary carrier authority (SCA) signal. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	03.12 Analyze, troubleshoot & adjust phase modulation circuits. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification
03.13 Analyze, troubleshoot & adjust FM pulse modulation circuits. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	03.14 Analyze, troubleshoot & adjust FM multiplex circuits. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	03.15 Analyze, troubleshoot & adjust wide band & narrow band FM transceiver circuits. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification
03.16 Set up & adjust FM antenna systems using a power meter & SWR meter. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	03.17 Analyze or measure FM radio circuits using spectrum analyzers, noise analyzers, impedance bridges, sweep generators, dummy loads & phase meters. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	03.18 Analyze & measure FM radio signals using power meters, field strength meters & distortion meters. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification
03.19 Analyze, troubleshoot & adjust FM heterodyning, frequency synthesis, phased locked looped, signal filtering & automatic control circuits. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	03.20 Analyze, troubleshoot & adjust RF power amplifier circuits for FM radio transmitters. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	1 ☐ 2 ☐ 3 ☐ K ☐ Verification

1 ☐ 2 ☐ 3 ☐ K ☐ Verification	1 ☐ 2 ☐ 3 ☐ K ☐ Verification	1 ☐ 2 ☐ 3 ☐ K ☐ Verification

04.0 DEMONSTRATE PROFICIENCY IN HIGH FREQUENCY AM AND FM TWO-WAY RADIO SYSTEMS.

04.01 Apply Federal Communications Commission (FCC) rules & regulations to communication requirements. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	04.02 Describe the operation of high frequency (HF), very high frequency (VHF) & ultra high frequency (UHF) AM & FM two-way radio systems. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	04.03 Identify the stages of HF, VHF & UHF AM & FM two-way radio systems. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification
04.04 Analyze & troubleshoot HF, VHF & UHF AM & FM two-way radio transmitter & receiver circuits. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	04.05 Set up & adjust HF, VHF & UHF AM & FM antenna systems. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	04.06 Analyze & troubleshoot the DC remote control on repeater & remoted base auxiliary equipment. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification
04.07 Analyze & troubleshoot the tone remote control on repeater & remoted base auxiliary equipment. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	04.08 Analyze & troubleshoot the local remote control on repeater & remote base auxiliary equipment. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	04.09 Analyze & troubleshoot the RF remote control on repeater & remoted base auxiliary equipment. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification
04.10 Explain paging & mobile phone communications theory & language. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	04.11 Analyze & troubleshoot paging & mobile phone two-tone & five-tone paging & digital formats. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	04.12 Analyze & troubleshoot paging & mobile phone signaling & operation. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification
04.13 Service & repair cellular mobile phones & pagers. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	1 ☐ 2 ☐ 3 ☐ K ☐ Verification	1 ☐ 2 ☐ 3 ☐ K ☐ Verification
1 ☐ 2 ☐ 3 ☐ K ☐ Verification	1 ☐ 2 ☐ 3 ☐ K ☐ Verification	1 ☐ 2 ☐ 3 ☐ K ☐ Verification

05.0 DEMONSTRATE PROFICIENCY IN MICROWAVE SYSTEMS.

05.01 Describe the operation of microwave transmission systems. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	05.02 Identify the components of microwave transmission systems. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	05.03 Analyze & troubleshoot microwave transmitter & receiver circuits. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification
05.04 Conduct operating systems checks of microwave transmitters & receivers & make minor adjustments. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	05.05 Identify local codes & deed restrictions applicable to site surveys for microwave installations. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	05.06 Set up & adjust microwave antenna systems. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification
05.07 Measure microwave system power & SWR. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	05.08 Describe procedures to interface a microwave system to a public switched telephone network. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	1 ☐ 2 ☐ 3 ☐ K ☐ Verification
1 ☐ 2 ☐ 3 ☐ K ☐ Verification	1 ☐ 2 ☐ 3 ☐ K ☐ Verification	1 ☐ 2 ☐ 3 ☐ K ☐ Verification

06.0 DEMONSTRATE PROFICIENCY IN SATELLITE SYSTEMS.

06.01 Describe the operation of satellite systems. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	06.02 Identify the components of satellite systems. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	06.03 Describe the process of time division multiplexing & frequency division multiplexing used with satellite transponders. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification
06.04 Analyze, troubleshoot & adjust satellite transponder circuits using a high frequency sweep generator & frequency counter. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	06.05 Analyze & troubleshoot video & audio demodulators in satellite receivers. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	06.06 Determine location data for satellites. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification

06.07 Identify local codes & deed restrictions applicable to site surveys for satellite systems. 1 2 3 K Verification	06.08 Set up & adjust satellite antenna systems. 1 2 3 K Verification	06.09 Analyze & troubleshoot a satellite receiver low noise amplifier & down converter. 1 2 3 K Verification
06.10 Describe procedures to interface satellite systems with two-way up link & down link communications equipment. 1 2 3 K Verification	1 2 3 K Verification	1 2 3 K Verification
1 2 3 K Verification	1 2 3 K Verification	1 2 3 K Verification

07.0 DEMONSTRATE PROFICIENCY IN VIDEO SYSTEMS.

07.01 Analyze & adjust the composition of video signals. 1 2 3 K Verification	07.02 Define the principles of video signal generation. 1 2 3 K Verification	07.03 Describe the principles of video multiplex circuits. 1 2 3 K Verification
07.04 Analyze & adjust black & white & color display circuits. 1 2 3 K Verification	07.05 Analyze, troubleshoot & adjust the color component of a signal. 1 2 3 K Verification	07.06 Analyze, troubleshoot & adjust the luminance component of a signal. 1 2 3 K Verification
07.07 Analyze & troubleshoot the synchronous, horizontal & vertical components of a signal. 1 2 3 K Verification	07.08 Measure the signal-to-noise ratio for video signals. 1 2 3 K Verification	07.09 Analyze video circuits using a spectrum analyzer. 1 2 3 K Verification
07.10 Interconnect video system components using coaxial cables. 1 2 3 K Verification	07.11 Analyze, troubleshoot & adjust video & RF distribution systems. 1 2 3 K Verification	07.12 Analyze & adjust a modulator for a video distribution system. 1 2 3 K Verification

1 ☐ 2 ☐ 3 ☐ K ☐ Verification	1 ☐ 2 ☐ 3 ☐ K ☐ Verification	1 ☐ 2 ☐ 3 ☐ K ☐ Verification

08.0 DEMONSTRATE PROFICIENCY IN COMMERCIAL AUDIO SYSTEMS.

08.01 Describe the functions of communication system audio components. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	08.02 Analyze, troubleshoot & adjust audio amplifier components & speaker system components. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	08.03 Define the application of microphone & speaker systems. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification
08.04 Describe the application of wireless microphones with frequency diversity & the use of equalizers & time delay systems. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	08.05 Determine the impedance & power requirements of microphones & speakers. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	1 ☐ 2 ☐ 3 ☐ K ☐ Verification
1 ☐ 2 ☐ 3 ☐ K ☐ Verification	1 ☐ 2 ☐ 3 ☐ K ☐ Verification	1 ☐ 2 ☐ 3 ☐ K ☐ Verification

09.0 DEMONSTRATE PROFICIENCY IN DATA COMMUNICATIONS.

09.01 Describe the operation of data communications systems. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	09.02 Identify the components of data communications systems. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	09.03 Analyze & define data communication codes, formats & protocols. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification
09.04 Identify serial & parallel ports & explain their use. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	09.05 Describe the principles of synchronous & asynchronous data transmission systems. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	09.06 Identify types of modems & modulation techniques. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification

09.07
Set up & operate modems.
1 ☐
2 ☐
3 ☐
K ☐
Verification

09.08
Isolate problems of modem operation or common carrier lines.
1 ☐
2 ☐
3 ☐
K ☐
Verification

09.09
Analyze & troubleshoot modems.
1 ☐
2 ☐
3 ☐
K ☐
Verification

09.10
Identify & describe types of carrier systems.
1 ☐
2 ☐
3 ☐
K ☐
Verification

09.11
Interconnect systems using the RS-232 interface standard.
1 ☐
2 ☐
3 ☐
K ☐
Verification

09.12
Describe the operation & bus architecture of local area networks.
1 ☐
2 ☐
3 ☐
K ☐
Verification

09.13
Analyze & troubleshoot base band & broad band local area networks.
1 ☐
2 ☐
3 ☐
K ☐
Verification

09.14
Identify telephone terms & procedures for interfacing wire lines with data networks.
1 ☐
2 ☐
3 ☐
K ☐
Verification

09.15
Analyze & troubleshoot the data communications systems associated with automatic teller machines & credit card readers.
1 ☐
2 ☐
3 ☐
K ☐
Verification

09.16
Describe the operation of lasers used with data transmission.
1 ☐
2 ☐
3 ☐
K ☐
Verification

1 ☐
2 ☐
3 ☐
K ☐
Verification

1 ☐
2 ☐
3 ☐
K ☐
Verification

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Verification

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3 ☐
K ☐
Verification

1 ☐
2 ☐
3 ☐
K ☐
Verification

10.0 DEMONSTRATE PROFICIENCY IN FIBER OPTIC COMMUNICATIONS SYSTEMS.

10.01
Identify & describe the basic characteristics of optics such as reflection, refraction & total reflection.
1 ☐
2 ☐
3 ☐
K ☐
Verification

10.02
Identify the characteristics & components of fiber optic cables.
1 ☐
2 ☐
3 ☐
K ☐
Verification

10.03
Describe the modes of propagation used in fiber optic cables.
1 ☐
2 ☐
3 ☐
K ☐
Verification

10.04
Identify bandwidth & attenuation limitations for fiber optic systems.
1 ☐
2 ☐
3 ☐
K ☐
Verification

10.05
Describe the technique of wavelength multiplexing in fiber optic cables.
1 ☐
2 ☐
3 ☐
K ☐
Verification

10.06
Identify & describe the characteristics of various types of light sources & light emitting diodes used for fiber optic systems.
1 ☐
2 ☐
3 ☐
K ☐
Verification

10.07 Identify & describe the components of fiber optic transmission systems. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	10.08 Assemble a simple fiber optic data transmission system. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	10.09 Analyze & troubleshoot the components of fiber optic data transmission systems. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification
10.10 Describe the procedures used to interface fiber optic systems with microwave & satellite data transmission systems. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	1 ☐ 2 ☐ 3 ☐ K ☐ Verification	1 ☐ 2 ☐ 3 ☐ K ☐ Verification
1 ☐ 2 ☐ 3 ☐ K ☐ Verification	1 ☐ 2 ☐ 3 ☐ K ☐ Verification	1 ☐ 2 ☐ 3 ☐ K ☐ Verification
1 ☐ 2 ☐ 3 ☐ K ☐ Verification	1 ☐ 2 ☐ 3 ☐ K ☐ Verification	1 ☐ 2 ☐ 3 ☐ K ☐ Verification
1 ☐ 2 ☐ 3 ☐ K ☐ Verification	1 ☐ 2 ☐ 3 ☐ K ☐ Verification	1 ☐ 2 ☐ 3 ☐ K ☐ Verification
1 ☐ 2 ☐ 3 ☐ K ☐ Verification	1 ☐ 2 ☐ 3 ☐ K ☐ Verification	1 ☐ 2 ☐ 3 ☐ K ☐ Verification
1 ☐ 2 ☐ 3 ☐ K ☐ Verification	1 ☐ 2 ☐ 3 ☐ K ☐ Verification	1 ☐ 2 ☐ 3 ☐ K ☐ Verification
1 ☐ 2 ☐ 3 ☐ K ☐ Verification	1 ☐ 2 ☐ 3 ☐ K ☐ Verification	1 ☐ 2 ☐ 3 ☐ K ☐ Verification

COMMUNICATION ELECTRONICS

0.0 DEMONSTRATE EMPLOYABILITY SKILLS.

0.01 Conduct a job search. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	0.02 Secure information about a job. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	0.03 Identify documents that may be required when applying for a job. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification
0.04 Complete a job application form correctly. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	0.05 Demonstrate competence in job interview techniques. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	0.06 Identify or demonstrate appropriate responses to criticism from employer, supervisor or other persons. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification
0.07 Identify acceptable work habits. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	0.08 Demonstrate knowledge of how to make job changes appropriately. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	0.09 Demonstrate acceptable employee health habits. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification

00.0 DEMONSTRATE AN UNDERSTANDING OF ENTREPRENEURSHIP.

00.01 Define entrepreneurship. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	00.02 Describe the importance of entrepreneurship to the American economy. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	00.03 List the advantages & disadvantages of business ownership. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification
00.04 Identify the risks involved in ownership of a business. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	00.05 Identify the necessary personal characteristics of a successful entrepreneur. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification	00.06 Identify the business skills needed to operate a small business efficiently & effectively. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification
1 ☐ 2 ☐ 3 ☐ K ☐ Verification	1 ☐ 2 ☐ 3 ☐ K ☐ Verification	1 ☐ 2 ☐ 3 ☐ K ☐ Verification

P.O.W.E.R. SKILLS (PRINCIPLES OF WORK ENVIRONMENT READINESS)

000.0 COOPERATIVE WORK EXPERIENCE COMPETENCIES.

1 ☐ 2 ☐ 3 ☐ K ☐ Verification	1 ☐ 2 ☐ 3 ☐ K ☐ Verification	1 ☐ 2 ☐ 3 ☐ K ☐ Verification
1 ☐ 2 ☐ 3 ☐ K ☐ Verification	1 ☐ 2 ☐ 3 ☐ K ☐ Verification	1 ☐ 2 ☐ 3 ☐ K ☐ Verification
1 ☐ 2 ☐ 3 ☐ K ☐ Verification	1 ☐ 2 ☐ 3 ☐ K ☐ Verification	1 ☐ 2 ☐ 3 ☐ K ☐ Verification
1 ☐ 2 ☐ 3 ☐ K ☐ Verification	1 ☐ 2 ☐ 3 ☐ K ☐ Verification	1 ☐ 2 ☐ 3 ☐ K ☐ Verification
1 ☐ 2 ☐ 3 ☐ K ☐ Verification	1 ☐ 2 ☐ 3 ☐ K ☐ Verification	1 ☐ 2 ☐ 3 ☐ K ☐ Verification
1 ☐ 2 ☐ 3 ☐ K ☐ Verification	1 ☐ 2 ☐ 3 ☐ K ☐ Verification	1 ☐ 2 ☐ 3 ☐ K ☐ Verification
1 ☐ 2 ☐ 3 ☐ K ☐ Verification	1 ☐ 2 ☐ 3 ☐ K ☐ Verification	1 ☐ 2 ☐ 3 ☐ K ☐ Verification

VERIFICATION

The instructor should verify the level of mastery achieved by the student by initialing the competency box each time the student masters a competency. Later, if the student achieves a higher degree of mastery of a competency, the higher degree should be recorded and verified by the instructor.

INSTRUCTOR SHOULD SIGN FULL NAME AND SCHOOL NAME AND ADDRESS IN THE SPACE BELOW.

Verification	Signature
	Title
	School Name
	School Address

Verification	Signature
	Title
	School Name
	School Address

Verification	Signature
	Title
	School Name
	School Address

COOPERATIVE WORK EXPERIENCE

In addition to classroom training and laboratory performance identified on the Career MAP, this student has participated in cooperative work experience with employers as shown below:

Dates _____ Employer _____

Address of Employer _____

Supervisor _____

Supervisor Title _____

Dates _____ Employer _____

Address of Employer _____

Supervisor _____

Supervisor Title _____

Dates _____ Employer _____

Address of Employer _____

Supervisor _____

Supervisor Title _____

NOTES

This section of the MAP is provided so the instructor, employer, or student may list additional qualifying statements or other pertinent information. All comments should be initialed for verification.

State of Florida
Department of Education
Tallahassee, Florida
Betty Castor, Commissioner
Affirmative action/equal opportunity employer

IE572 BK-91